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09/731,640	12/07/2000	Joshua I. Pine	044368.0371	9957

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EXAMINER

HENN, TIMOTHY J

ART UNIT	PAPER NUMBER
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2612

DATE MAILED: 06/16/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/731,640

Applicant(s)

PINE, JOSHUA I.

Examiner

Timothy J Henn

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 December 2000.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 07 December 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Specification

1. The disclosure is objected to because of the following informalities:
 - i. On page 4, line 7 replace "130.The" with --130. The--
 - ii. On page 4, line 10 replace "imager 118 may comprises" with --
imager 118 may comprise--
 - iii. On page 8, line 2 replace "(not shown).The" with
--(not shown). The--

Appropriate correction is required.

2. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed. The office notes that the title should make some mention of the use both optical and digital systems for image transformations (i.e. Fourier transforms).

Claim Objections

3. Claim 7 is objected to because of the following informalities: Delete the second "." on line 13 of claim 7. Appropriate correction is required.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

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(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1, 3-6, 15, 17, 18 and 20-22 are rejected under 35 U.S.C. 102(b) as being anticipated by Kostrzewski et al. (SPIE).

[claim 1]

In regard to claim 1, note that Kostrzewski et al. discloses an imaging system comprising an imager having an array of photocells, where each photocell produces an electrical response to light exposure (Figure 1, "CCD Camera"), and the electrical responses of the array of photocells together represent spatial frequency-domain image data (Figure 1, The office notes that since the incoming light passes through a Fourier lens, the image data captured by the CCD will represent spatial frequency-domain image data); and an image processor (e.g. Figure 1, "DSP chip") that receives the spatial frequency-domain image data from the imager and transforms the spatial frequency-domain image data into spatial-domain image data (Section 2; Paragraph 1).

[claim 3]

In regard to claim 3, note that Kostrzewski et al. further discloses a user interface that displays the spatial-domain image data (e.g. Figure 1, "Host Computer"; Figure 3, "Correlation Display").

[claim 4]

In regard to claim 4, note that Kostrzewski et al. further discloses an optical lens placed between a spatial representation of an image object and the imager, the optical lens performing an approximate Fourier transform on light emanating from the spatial

representation of the image object towards the imager (Figure 1, "Fourier Lens").

[claim 5]

In regard to claim 5, note that Kostrzewski et al. further discloses a spatial representation of the image object provided by a spatial light modulator (e.g. Figure 1, "Input SLM").

[claim 6]

In regard to claim 6, note that Kostrzewski et al. further disclose a coherent light source for illuminating the spatial representation of the image (Figure 1, "Laser").

[claim 15]

In regard to claim 15, note that Kostrzewski et al. discloses a method comprising capturing a diffraction pattern of an image object (e.g. Figure 1, "CCD Camera"; Section 2); producing spatial frequency-domain image data corresponding to the captured diffraction pattern of the object (Figure 1; Section 2; The office notes that an A-to-D converter is inherent in the system since the data is processed using a digital signal processor, it must be converted to digital data prior to processing); and converting the spatial frequency-domain image data to a spatial domain (Figure 1; Section 2).

[claim 17]

In regard to claim 17, note that Kostrzewski et al. further discloses transferring the spatial frequency-domain image data to an image processor, the image processor inverse Fourier transforming the frequency-domain data to a spatial domain (Section 2, Paragraph 1).

[claim 18]

In regard to claim 18, note that Kostrzewski et al. further discloses placing a transform lens (Figure 1, "Fourier Lens") between an image object and the digital imager, the transform lens performing an approximate Fourier transform on light traveling between the object and the digital imager.

[claim 20]

In regard to claim 20, note that Kostrzewski et al. further discloses displaying the spatial-domain image data (e.g. Figure 3, "Correlation display").

[claim 21]

In regard to claim 21, note that Kostrzewski et al. discloses an imaging system comprising means for capturing an image in the spatial frequency domain (Figure 1, "CCD Camera"); means communicatively coupled with the capturing means for creating a digital representation of the spatial frequency components of the captured image (Figure 1; Section 2; The office notes that an A-to-D converter is inherent in the system since the data is processed using a digital signal processor, it must be converted to digital data prior to processing); and means communicatively coupled with the digital representation creation means for transforming the digital representation of the spatial frequency components into spatial-domain image data (Figure 1, "DSP chip"; Section 2).

[claim 22]

In regard to claim 22, note that Kostrzewski et al. discloses a system comprising : means for capturing a diffraction pattern of an image object (Figure 1, "CCD Camera", Section 2), means communicatively coupled with the capturing means for producing

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digital spatial frequency-domain image data of the captured diffraction pattern of the object (Figure 1; Section 2; The office notes that an A-to-D converter is inherent in the system since the data is processed using a digital signal processor, it must be converted to digital data prior to processing); and means coupled with the data producing means for converting the spatial frequency-domain image data to a spatial domain (Figure 1, "DSP chip"; Section 2).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kostrzewski et al. (SPIE) as applied to claim 15 above, and further in view of Nagumo (US 4,189,751)

[claim 16]

In regard to claim 16, note that Kostrzewski et al. discloses a method which meets the requirements of claim 15 as discussed above. Therefore, it can be seen that Kostrzewski et al. lacks a method which further comprises detecting and removing noise from the captured spatial frequency-domain image data.

Nagumo discloses a noise removal system to remove noise caused by inconsistencies which are inherent due to the manufacturing variations of solid-state

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image sensors by detecting and removing noise signals from captured image data (e.g. Figure 2; Column 1, Line 31 - Column 2, Line 19). It would have been obvious to one of ordinary skill in the art at the time the invention was made to capture and remove the undesirable noise signals as taught by Nagumo to improve the quality of the captured image.

8. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kostrzewski et al. (SPIE).

[claim 19]

In regard to claim 19, note that Kostrzewski et al. lacks storing of the spatial-domain image data in a digital memory. However, it is well known in the art to store images in digital memory for later processing, printing or review (Official Notice). Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to store the spatial-domain image data of Kostrzewski et al. to be able to process, print or review the image data at a later time.

9. Claims 1-4, 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Atrigalas (US 5,181,102).

[claim 1]

In regard to claim 1, note that Artigalas discloses an imaging system comprising an imager having an array of photocells, where each photocell produces an electrical response to light exposure (Figure 2, Item 1; Column 1, Lines 53-55), and the electrical

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responses of the array of photocells together represent spatial frequency-domain image data (Figure 2, The office notes that since the incoming light passes through a Fourier lens, the image data captured by the CCD will represent spatial frequency-domain image data). Therefore, it can be seen that Artigalas does not disclose an image processor that receives the spatial frequency-domain image data from the imager and transforms the spatial frequency-domain image data into spatial-domain image data.

However, it is noted that Artigalas discloses the a system which is used to remove noise from video signals which are fed into a high-definition television (e.g. Column 1, Line 5 - Column 2, Line 17). It is noted that it is well known in the television art to display images in spatial-domain rather than in the frequency-domain in order to present the viewer with an easily understood image (Official Notice). Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to convert the spatial frequency-domain image data into spatial-domain image data through a suitable inverse process using an image processor to present the viewer with an easily understood image display.

[claim 2]

In regard to claim 2, note that Artigalas discloses a filter (Figure 2, Item 92) that detects and removes high diagonal spatial frequencies or "noise" before the system transforms the spatial frequency-domain image data into spatial-domain image data.

[claim 3]

In regard to claim 3, note that Artigalas discloses the displaying of the spatial-domain image data on a television or "user interface" (e.g. Column 1, Line 5 - Column 2,

Line 17).

[claim 4]

In regard to claim 3, note that Artigalas further discloses an optical lens (Figure 2, Item 91) placed between a spatial representation of an image object and the imager, the optical lens performing an approximate Fourier transform (Column 3, Lines 23-33) on light emanating from the spatial representation of the image object towards the imager.

[claim 7]

In regard to claim 7, note that Artigalas further discloses a focusing lens (Figure 2, Item 4) and a transform lens (Figure 2, Item 91) that are placed between the imager and an image object; light traveling from the image object to the imager; the focusing lens focusing the light onto an image plane between the focusing lens and the transform lens (The office notes that the position of the focusing plane is inherent if the image is to be well-focused on the image sensor); the transform lens receiving the light from the focusing lens and bending the light to form a diffraction pattern of the image object at a transform plane of the transform lens (Column 3, Lines 23-33); and the imager being placed at the transform lane of the transform lens to capture the diffraction pattern of the object (Figure 2).

[claim 8]

In regard to claim 8, Artigalas discloses all limitations except for a user interface that permits the user to adjust distances between the focusing lens, the transform lens and the imager. However, it is well known in the art to allow users to adjust the relative positions of lenses in optical systems in order to properly calibrate the system to obtain

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the best quality images possible from the system (Official Notice). Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to include a user interface to adjust the relative positions of the focus lens, transform lens and imager to obtain the best quality images possible from the system.

10. Claims 9-15 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Artigalas (US 5,181,102) in view of Fowler et al. (US 5,461,425).

[claim 9]

In regard to claim 9, note that Artigalas discloses digital imaging means for capturing a diffraction pattern of an object illuminated by an incoherent light source (Figure 2, Item 1). Therefore, it can be seen that Artigalas lacks means for converting the spatial frequency-domain image data into spatial-domain image data suitable for spatial image display of the object.

However, it is noted that Artigalas discloses the a system which is used to remove noise from video signals which are fed into a high-definition television (e.g. Column 1, Line 5 - Column 2, Line 17). It is noted that it is well known in the television art to display images in spatial-domain rather than in the frequency-domain in order to present the viewer with an easily understood image (Official Notice). Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to convert the spatial frequency-domain image data into spatial-domain image data through a suitable inverse process using an image processor to present the viewer with an easily understood image display. It can further be seen that Artigalas lacks

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digital imaging means for producing digital spatial frequency-domain image data corresponding to the captured diffraction pattern of the object.

It is further noted that Artigalas discloses that the use of "other types of sensors such as, for example, matrix-structure sensors, do[es] not depart from the scope of the present invention". Fowler et al. discloses an image sensor which includes pixel level A/D conversion, a technique which reduces the effect of parasitic capacitances on the readout bit lines (e.g. Column 4, Lines 13-17). Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the image sensor of Fowler et al. to readout the spatial frequency-domain image data digitally rather than in analog form to reduce the effects of parasitic capacitances.

[claim 10]

In regard to claim 10, note that Artigalas further discloses means for detecting and removing high diagonal frequencies or "noise" from the spatial frequency-domain image data (Figure 2, Item 92).

[claim 11]

In regard to claim 11, note that Artigalas further discloses means for displaying a spatial image of the object (e.g. Column 1, Line 5 - Column 2, Line 17).

[claim 12]

In regard to claim 12, note that Artigalas lacks means for storing the spatial-domain image data of the object. However, it is well known in the art to store images in digital memory for later processing, printing or review (Official Notice). Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was

made to include a device to store the spatial-domain image data of Kostrzewski et al. to be able to process, print or review the image data at a later time.

[claim 13]

In regard to claim 13, note that Artigalas lacks a user interface means for controlling an amount of time for capturing the image. However, it is well known in the art to provide cameras with exposure control systems to limit the amount of light during a single exposure to avoid saturating the photo sensors of the imaging device (Official Notice). Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to include an exposure control system to avoid saturating the photo sensors of the imaging device.

[claim 14]

In regard to claim 14, note that Artigalas lacks a user interface means for controlling an amount of illumination for capturing images. However, it is well known in the art to provide cameras with exposure control systems to limit the amount of light during a single exposure to avoid saturating the photo sensors of the imaging device (Official Notice). Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to include an exposure control system to avoid saturating the photo sensors of the imaging device.

[claim 15]

In regard to claim 15, note that Artigalas discloses a method comprising capturing a diffraction pattern of an image object (e.g. Figure 2; Column 3, Lines 23-33). Therefore it can be seen that Artigalas lacks a method of converting the spatial

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frequency-domain image data to a spatial domain.

However, it is noted that Artigalas discloses the a system which is used to remove noise from video signals which are fed into a high-definition television (e.g. Column 1, Line 5 - Column 2, Line 17). It is noted that it is well known in the television art to display images in spatial-domain rather than in the frequency-domain in order to present the viewer with an easily understood image (Official Notice). Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to convert the spatial frequency-domain image data into spatial-domain image data through a suitable inverse process using an image processor to present the viewer with an easily understood image display. It can further be seen that Artigalas lacks producing digital spatial frequency-domain image data corresponding to the captured diffraction pattern of the object.

It is further noted that Artigalas discloses that the use of "other types of sensors such as, for example, matrix-structure sensors, do[es] not depart from the scope of the present invention". Fowler et al. discloses an image sensor which includes pixel level A/D conversion, a technique which reduces the effect of parasitic capacitances on the readout bit lines (e.g. Column 4, Lines 13-17). Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the image sensor of Fowler et al. to readout the spatial frequency-domain image data digitally rather than in analog form to reduce the effects of parasitic capacitances.

[claim 19]

In regard to claim 19, note that Artigalas lacks storing the spatial-domain image data in digital memory. However, it is well known in the art to store images in digital memory for later processing, printing or review (Official Notice). Therefore, It would have been obvious to one of ordinary skill in the art at the time the invention was made to store the spatial-domain image data of Kostrzewski et al. to be able to process, print or review the image data at a later time.

11. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Artigalas (US 5,181,102) in view of Fowler et al. (US 5,461,425) as applied to claim 15 above, and further in view of Nagumo (US 4,189,751).

[claim 16]

In regard to claim 16, note that Artigalas in view of Fowler et al. discloses a method which meets the requirements of claim 15 as discussed above. Therefore, it can be seen that Artigalas in view of Fowler et al. lacks a method which further comprises detecting and removing noise from the captured spatial frequency-domain image data.

Nagumo discloses a noise removal system to remove noise caused by inconsistencies which are inherent due to the manufacturing variations of solid-state image sensors by detecting and removing noise signals from captured image data (e.g. Figure 2; Column 1, Line 31 - Column 2, Line 19). It would have been obvious to one of ordinary skill in the art at the time the invention was made to capture and remove the

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undesirable noise signals as taught by Nagumo to improve the quality of the captured image.

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The following prior art further shows the current state of the art in combining Fourier transform optics with image sensors.

- i. Bouwhuis US 5,308,2239
- ii. Fourier optoelectronic signal pre-processor
Abdul Wahab and Beng H. Tan, Proc. SPIE Int. Soc. Opt. Eng.
2297, 368 (1994)
- iii. Fourier optical signal processors
Flannery, D.L.; Horner, J.L.;
Proceedings of the IEEE , Volume: 77 , Issue: 10 , Oct. 1989
Pages:1511 - 1527


13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Timothy J Henn whose telephone number is (703) 305-8327. The examiner can normally be reached on M-F 7:30 AM - 5:00 PM, alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wendy R Garber can be reached on (703) 305-4929. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

TJH
6/1/2004


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